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INITIAL DEVELOPMENT OF *Heteropterys tomentosa* IN DIFFERENT CONDITIONS OF SHADING, FERTILIZER AND CONTAINERS

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ABSTRACT

The availability of material for Heteropterys tomentosa is increasingly reduced to be exploited exclusively extractive way and it is important to establish the best conditions for the production of seedlings for cultivation and sustainable exploitation. The aim of this study was to evaluate the growth of seedlings of H. tomentosa under different shade conditions, fertilizer and containers. The experimental design was completely randomized in a 2x2x3 factorial design with five replicates of 20 plants. The treatments were two fertilization conditions: with and without phosphorus fertilization, two shaded conditions: seedlings in full sun and 50% light interception obtained with plastic screen-type shading, and three types of seedling containers: plastic tube with 0.17 cm3, plastic tube with 0.31 cm3 and plastic bag of polyethylene (11 cm x 30 cm). The height and leaves number were evaluated. The greatest growth in height and leaf number occurred in plastic bag and shaded environment, with no effect on P fertilization.

Keywords: Nó-de-cachorro; phosphorus; medicinal plants.

INTRODUCTION

Heteropterys tomentosa A. Juss. is a species of the Brazilian Cerrado known used by traditional communities for diseases of the reproductive system, circulatory, digestive and nervous (Coelho et al. 2011). It is also used against diabetes mellitus (Macedo et al. 2004) and has an aphrodisiac effect (Coelho et al. 2011). It occurs in small populations and the availability of raw materials for the pharmaceutical industry is increasingly reduced, since it is exploited exclusively extractive

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form (Barata et al. 2009). Thus, it is important to establish the best conditions for the production of seedlings of the species, with a view to its perpetuation and sustainable exploitation.

The propagation of *Heteropterys tomentosa* is by seed and seedling production is important to determine the best substrates, fertilization, lighting conditions and container volume (Coelho et al. 2011). The genetic constitution of the species, type of substrate handling and weather, in combination with the size of the plant to be lead to the field, determine the dimensions of the containers to be used in the production of seedlings, and have interference in cost production, transportation and planting (Gomes et al. 2003).

The attenuation of solar radiation is one of the most important factors for the production of seedlings, by acting directly on energy balance and, consequently, environmental conditions (Hernandes et al. 2004). The use of shading of seedlings during the nursery stay is common, but the species can respond in different ways to lower brightness (Melo & Cunha 2008).

In the production of seedlings in the nursery it is also necessary to consider economic aspects and work efficiency. The plastic bag has overcome the other vessels and have been widely used in the production of seedlings because it has higher availability, lower price and easy handling in nurseries, providing good yield in seedling production (Gomes et al. 2003), but has the disadvantage of take up much space in the nursery.

The use of plastic tubes has advantages such as reducing hand labor and operating costs, the possibility of automation of various operations, improving the ergonomic aspects of production because workers work standing, and reduction of plastic waste, because the tubes can be reused. However, the reduced substrate volume imposes restrictions on the development of the root system of plants, which may cause, depending on the species, stress and strain of the root system after planting.

On the other hand, a major limitation to the cultivation of native species is the lack of information about the nutritional and physiological requirements, especially in relation to medicinal. Evidence indicates that the growth of many tropical species is limited by nutritional constraints soil (Dias et al. 1991) and fertilization is recommended in these cases.

The objective of this study was to evaluate the influence of shading, fertilization and type of container on the development of *Heteropterys seedlings* tomentosa A. Juss.

MATERIAL AND METHODS

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The experiment was conducted from June to December 2011 in the nursery of the Faculty of Agronomy and Veterinary Medicine, Federal University of Mato Grosso (FAMEV) in Cuiabá - Mato Grosso, Brazil, coordinates 15º35'56 "S and 56º06'01" W , altitude of 165 m, warm tropical and sub-humid, with average annual rainfall of 1,750 mm, average annual temperature of 24ºC, the highest maximum being 43 °C and the lowest minimum 0ºC (Maitelli 2005).

The experimental design was completely randomized in a factorial 2x2x3, with five replicates of 20 plants. The treatments were: two fertilization conditions: with and without phosphorus fertilization; two shade conditions: seedlings in full sun and 50% light interception obtained with plastic screen type shading; three types of containers for plants: cartridge of 17 cm^3, 31 cm^3 of cartridge and a plastic bag of polyethylene (11x30cm) of 1155.47 cm^3.

The seeds were germinated in the sandbox and the transplanted seedlings to the containers when they were with approximately three centimeters in height.The phosphorus fertilization was done with superphosphate, using one kilogram per cubic meter of substrate. The substrate of the seedlings was a mixture of sand, black soil, carbonized rice hull, manure and vermiculite (1: 1: 1: 1: 1) and the physical and chemical composition is shown in Table 1.

Table 1. Chemical and physical characteristics of substrates with and without phosphorus fertilization. Cuiabá 2011.

Substrate	pH		H+Al	Al	Ca+Mg	Ca	Mg	K	P	M.O	Sand	Silt	Clay
	H_2O	$CaCl_2$	$cmol_c.dm^{-3}$					$mg.dm^{-3}$	$g.\ dm^{-3}$		$g.kg^{-1}$		
With Fertilizer	7,1	6,4	1,7	0,0	7,9	4,1	3,8	610	184,2	25,8	733	50	217
Without fertilizer	7,0	6,3	2,0	0,0	7,0	3,7	3,3	590	173,7	26,6	716	67	217

Analysis by the FAMEV Soils Laboratory.

The height characteristics of the plant and leaf number were evaluated every 35 days until 175 after sowing. Height was obtained by taking the distance between the neck and the apical bud. The data obtained at the end of the experiment were subjected to analysis of variance by F test and the normality and homogeneity tests. The data describing seedling growth during the period of observation, when the analysis of variance of regression was significant at 5%, were adjusted second degree polynomial models, because these showed the highest R^2.

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RESULTS AND DISCUSSION

There was a difference between the average number of leaves and plant height for factors like container and shading, but there was no difference for the fertilization factor, and the shading interaction x container, shading x fertilization, container x fertilization and shading x container x fertilization (Table 2).

Table 2. Mean square of the number of leaves and plant height of *Heteropteris tomentosa* A. Juss. in different containers and shading and fertilization conditions. Cuiabá 2011.

Source of variation	G.L.	Mean square	
		Number of leaves	Plant height
Total reduction	11	3,426223	5,988030
Container	2	12,25036**	24,85001**
Shadowing	1	7,241644**	6,879614*
Fertilizing	1	1,366877 ns	0,9318666 ns
Container x shading	2	0,9290883 ns	0,6309842 ns
Container x fertilization	2	0,4860492 ns	1,089452 ns
Shadowing x fertilization	1	0,3413807 ns	1,365528 ns
Container x shading x fertilization	2	0,7037723 ns	1,775214 ns
Residue	36	0,5986616	1,484739
C.V. (%)		11,33	15,49

GL = degrees of freedom, (ns) not significant (**, *) significant at levels 1 and 5% probability, respectively, by F test.

The absence of phosphorus fertilization effect on seedling growth *Heteropterys tomentosa*, indicates that other factors are more important in the development of seedlings and more studies are needed on phosphorus fertilization with the species, because the literature contained only the study of Coelho et al. (2008) found that the best substrate (among Cerrado soil, black soil + vermiculite (2: 1), black soil + carbonized rice (2: 1), black soil + cattle manure (2: 1) and black earth) for the production of *H. tomentosa* seedlings is the soil of the Cerrado, with low pH and low phosphorus.

Studies conducted with other native species have shown similar behavior *Heteropterys tomentosa*, or lack of response to fertilization. Seedlings of *Bowdichia virgilioides* H.B.K. and *Tabebuia caraiba* (Mart.) Bur., species also the Cerrado as *Heteropterys tomentosa*, did not respond to fertilization (Brauwers et al. 2002).

Seedlings planted in smaller volume containers (tubes) in full sun remained almost the same time during the observation period, with lower values than seedlings grown in plastic bags(Figure 1A); which was also observed in the condition of 50% shading, which was well adjusted to the quadratic model (R^2 = 0.99) (Figure 1 C).

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Thus, it is noted that the plastic bag substrate volume was sufficient for further growth *Heteropterys tomentosa* seedlings while the used tubes showed lower volume and impaired growth.

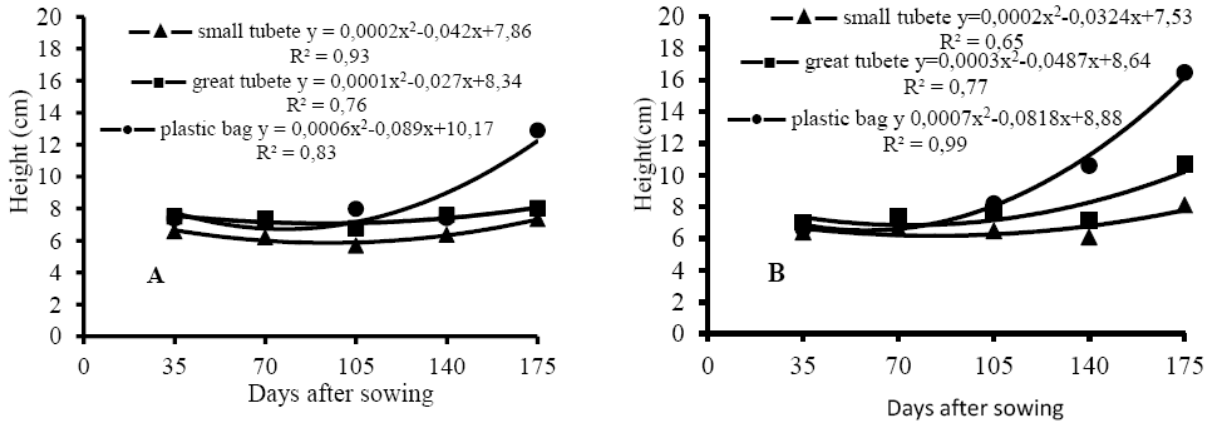

Figure 1. Height of plants *Heteropterys tomentosa* full sun (A) and provided 50% of shading (B) in different containers. Cuiabá 2011.

The greater height of plants in shading conditions (Figure 1C) is according to many authors, among them are: Santos et al. (2010), Siebeneichlen et al. (2008), Hall & Endres (2008) and Zanella et al. (2006).

By studying the effect of shading in the production of seedlings *Calophyllum brasiliense*, Laura et al. (2009) found that the treatment of 50% shading was superior in all characteristics evaluated in relation to other treatments, giving the best initial development, as well as the most suitable for the initial development of this kind and this was also checked in this job.

The shoot height is a feature that according to Melo & Cunha (2008), presents behavior inversely proportional to the light levels received by the plants and the rapid development achieved by the shaded seedlings is due to the search light for less favored plants.

The increase in light restriction plant height justified the action of auxin hormone that is synthesized in young leaves and shoots in the stem apex, and later transported to the root. In this case, the light function as an incentive for such transport, and when there is restriction of sunlight, the auxin is redistributed laterally to the epidermis and cortical hypocotyl cells, resulting in the elongation of these tissues and, therefore, the blanching (Taiz & Zeiger 2013). In

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study of container volume and substrate, Alves et al. (2012) found that the growth of *Anadenanthera macrocarpa* plants was influenced by container volume, so that bags with a volume 360 cm3, were not suitable for the production of plants of this species, and the best results were obtained in bags with volume 1660 cm^3.

Mesquita et al. (2011) Vallone et al. (2009) studied different species concluded that containers of lower volumes are responsible for the decrease in the development both of the seedlings in the nursery, the plants in the field, mainly due to the restriction in root development caused by the reduced volume of the container.

Furthermore, it was observed that the height of the seedlings was similar to 105 days in both plants grown under full sunlight as for seedlings grown in a greenhouse at 50% shading. So next research can evaluate the growth and productivity when transplanted with 105 days in those treatments, and the producer can save time and money by buying cheaper container and not producing under mesh.

The largest number of leaves occurred in the shaded condition and plastic bag (Figure 1B), while the plants in plastic pots both in full sun and under shade (Figure 1B and 1D), the number of leaves decreased, because despite being issued there leaves leaf fall in the observation period.

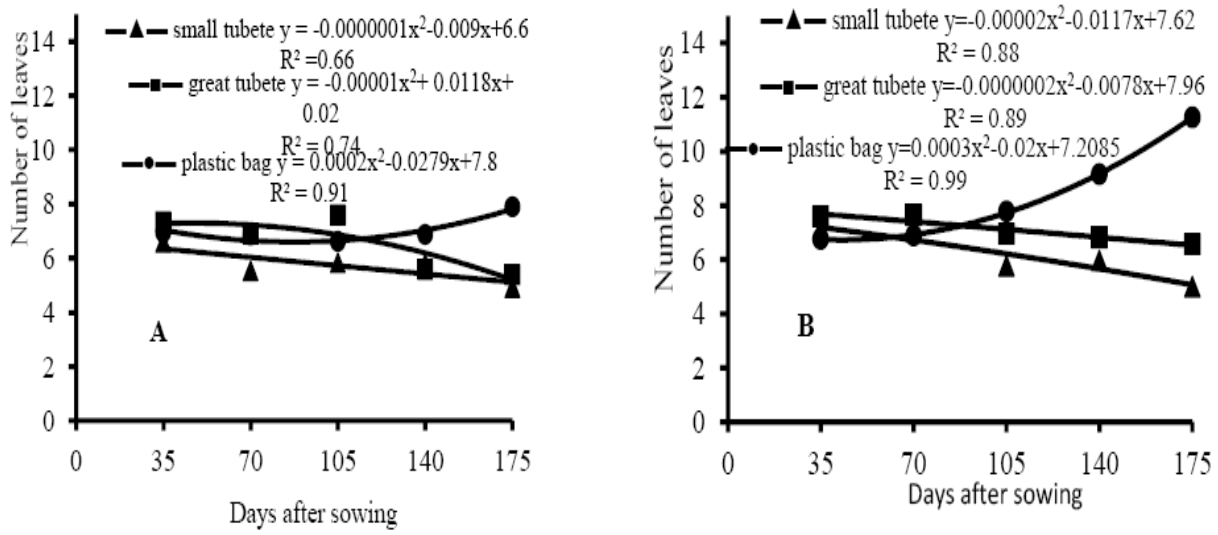

Figure 2. Number of leaves of plants *Heteropterys tomentosa* full sun (A) and provided 50% of shading (B) in different containers. Cuiabá 2011.

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Growing study of seedlings *Cordia trichotoma* (Vell.) Arrab. ex Steud and *Jacaranda micranta* Cham. Malavasi & Malavasi (2006) observed that the lower volume tubes (55cm^3) provided fewer leaves, however this same study, the authors found a higher number of leaves in full sun, unlike what occurred in *H. tomentosa* in this study.

CONCLUSIONS

Seedlings *Heteropterys tomentosa* exhibit greater growth when grown under nursery with 50% shading in plastic bags of polyethylene with 11 x 30 cm. The species does not respond to fertilization.

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